

interesting material

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70 lines

book review: Robert Jastrow "Journey to the Stars: Space Exploration---Tomorrow and Beyond" (Bantam Books)

ALSO OPPOSED

July 20, 1969: it was science-fiction realized. I peered at the cloudy images on the TV of astronauts Neil Armstrong and Buzz Aldrin bounding across the lunar landscape. But even then I can remember hearing voices who were asking how America could afford to send men to the moon while people were starving in the inner city.

Christian songwriter Larry Norman joked about the United States spending \$13 billion to bring rocks back from the moon, "Must be nice rocks."

In his recent book, "Journey to the Stars," scientist Robert Jastrow wrote that many space scientists ~~were also against~~ the expense of sending manned missions to the moon. The rock gathering had been accomplished by lunar probes as early as 1964. But Jastrow added that the moon trips were never about gathering rocks.

He cited a memo sent from NASA chief James Webb and Secretary of Defense Robert McNamara to President Kennedy: "It is men, not merely machines, in space that captures the imagination of the world."

Jastrow added, "The Apollo project cost about \$75 billion in 1989 dollars. No one would spend that kind of money to satisfy a scientist's curiosity about how the earth and moon were formed. The main goal of the Apollo landing was . . . to develop a U.S. capability for operating and maneuvering in space, so that we could maintain our presence there in the face of vigorous activity on the part of another great power. Some instinct told the American people that the mastery of space flight would be vital to the national interest."

Jastrow certainly has the credentials to write about space exploration. He was the founder and for ²⁰ ~~twenty~~ years the director of NASA's Goddard Institute for Space Studies. He also played a key role in NASA's decision to make the moon its first destination for manned flight.

Students of astronomy might be familiar with Jastrow's name from his textbook, "Astronomy: Fundamentals and Frontiers" which he co-authored with Malcolm McConnell in 1977. Textbook, particularly science textbooks, ordinarily don't wind up on anyones bestseller list, and textbook authors generally don't fare much better. But Jastrow appears to be the exception to the rule.

In three previous general release books, "Red Giants and White Dwarfs" (U), "Until the Sun Dies" (U) and "The Enchanted Loom" (U), Jastrow has sold more than one million copies. He appears to be continuing his successes with "Journey to the Stars."

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inside
Quots

Without burdening the reader with jargon or confusing illustrations---the bane of typical science textbooks---Jastrow explained the business of space exploration. From the early years at NASA when the decision was made to go to the moon, Jastrow swiftly moved to the ramifications of that journey's discoveries.

Jastrow wasn't afraid to point out the limitations of scientific inquiry while explaining the advances made with each discovery. For example, when he discussed the big bang theory of how the universe came into existence Jastrow pointed out that the very idea of the universe beginning at a specific moment in time creates some real problems for science.

He wrote, "This is a curiously biblical view of the origin of the world. The details of the astronomer's story differ greatly from those in the Bible . . . but the astronomical and biblical accounts of Genesis are alike in one essential respect. There was a beginning, and all things in the Universe can be traced back to it."

Jastrow explained, "Scientists are people who believe every event that occurs in the world can be explained by science in a rational way as the product of some previous event; they believe that science has an answer to nearly every question. Therefore, they ask themselves, 'Why did the Universe begin in an explosion? What did the Universe look like before the explosion? Did the Universe even exist prior to that moment?'"

But because the data cannot tell the scientists anything about the pre-big bang world Jastrow concluded, "To these questions they can find no answer---at least, not in science."

One notable flaw in Jastrow's book is that it doesn't seem to go deep enough with some subjects. This lack of depth might be because the book was written for the general public and not scientists. Another thing is that in touching on so many subjects related to space exploration it tends to feel a little unfinished, like someone gathered his scattered notes and made them into a book.

President Bush celebrated the ~~fortieth~~^{20th} anniversary of the first lunar landing by stating the government's commitment to send astronauts to Mars within the next ~~twenty~~ years. For those who feel that such a commitment is a repeat of errors made in the past, an afternoon spent with Jastrow's book might answer some of those old objections---like the price of moon rocks.

Robert Jastrow. "Journey to the Stars: Space Exploration---Tomorrow and Beyond." (Bantam Books)

INTRO: question of whether we are alone in the universe. TV/radio waves make intelligent life obvious; 15 billion years, average ET 1 billion years more advanced, not likely humanoid (looking at progress humans have made in 1 billion years---sponge life)

PART I: DAWN OF THE SPACE AGE

1. THE MOON BECKONS: '57, Russians beat US in space; US failures="Kaputnik," "Flopnik"; Jaz covers story attracts attention of Dr. Homer Newell, senior scientist Naval Research Lab--> NASA;

Harold Urey, "The Planets""Instead of being a dry discussion of the solar system, as such books usually are, it was enlivened by a sense of evolution in the Cosmos and the place our planet holds in the larger scheme of things. I detected that cosmological spark, and I thought, 'This is the approach to the subject that I must learn, and Harold Urey is the person I must learn it from.'" (p.11); moon the key to earth's history, untouched museum of artifacts stretching back to the earth's beginning. June 1959, administrator's progress report, "Lunar Exploration Project: Robert Jastrow, Project Officer . . ." 6 unmanned mission.

2. NEW EYES IN THE HEAVENS: Fast forward, July 20, 1969, first lunar landing; fellow scientists favored unmanned missions--didn't understand necessity of capturing the nation's imagination; in '64 they landed instruments on the moon but didn't stir world interest---did with manned landings

"The Apollo project cost about \$75 billion in 1989 dollars. No one would spend that kind of money to satisfy a scientist's curiosity about how the earth and moon were formed. The main goal of the Apollo landing was not to bring back the moon rocks, but to develop a U.S. capability for operating and maneuvering in space, so that we could maintain our presence there in the face of vigorous activity on the part of another great power. some instinct told the American people that the mastery of space flight would be vital to the national interest." (p. 26)

failure of shuttle, tension between pure scientific research and manned flight requirements--> financial constraints; prices have gone up: Voyager (Jupiter) \$400 million, Viking (Mars) \$2 billion, 4 planned space telescopes \$500 million to \$2 billion each; during Apollo \$20 billion each year --- during the '70s dropped to under \$6 billion a year, can't do \$20 billion work with \$6 billion budget (US economy grows during same period \$2 trillion to \$5 trillion, NASA budget at old percentage = \$50 billion)

necessity of space telescopes, next step of looking into deep space/history; detect radiation absorbed by earth's atmosphere: gamma rays, x rays, most wavelengths of infrared radiation . . . evidence of black holes . . .

discussion about anti-matter (p. 32)

PART II: THE COSMIC MYSTERIES

3. IN THE BEGINNING: "Dramatic discoveries in recent years have transformed man's picture of the Universe. No longer is the Cosmos a quiet place, traversed by stars and planets moving in stately procession. Today we know it to be richly populated by exotic objects, lashed by savage forces, and pregnant with surprises. Strange quasars light up the dark corners of the Universe; massive galaxies race across the sky; titanic explosions of unknown origin occur in the depths of space; and tentative evidence has been uncovered from the black hole---the most bizarre object ever conceived by the scientific mind." (p. 43)

1912, Amer. astronomer, Vesto Melvin Slipher, galaxies moving away
1920s-30s, Edwin Hubble and Milton Humason, big bang, 15 billion years ago

universe exploded into being, "This is a curiously biblical view of the origin of the world. The details of the astronomer's story differ greatly from those in the Bible; in particular the age of the Universe appears to be far greater than the 6,000 years of the biblical account; but the astronomical and biblical accounts of Genesis are alike in one essential respect. There was a beginning, and all things in the Universe can be traced back to it." (p. 47)

1965, physicists, Arno Penzias & Robert Wilson, big bang background noise (radiation)

"However, that picture creates a serious problem for science. Scientists are people who believe every event that occurs in the world can be explained by science in a rational way as the product of some previous event; they believe that science has an answer to nearly every question. Therefore, they ask themselves, 'Why did the Universe begin in an explosion? What did the Universe look like before the explosion? Did the Universe even exist prior to that moment?'

"To these questions they can find no answer---at least, not in science. James Peebles, an American astronomer who has made important contribution to the theory of the expanding Universe, said some years ago, 'What the Universe was like at day minus one before the Big Bang, one has no idea. The equations refuse to tell us. I refuse to speculate.' And the British physicist, Edward Milne, reflecting on the evidence for the expanding Universe, wrote, 'We can make no propositions about the state of affairs in the beginning; in the Divine Act of creation God is unobserved and unwitnessed.'" (p.49)

4. THE BIRTH OF THE STARS: story of events following Big Bang,

one second old: density of water, temp = one billion degrees, fundamental building blocks (electrons, protons, neutrons) condensed

three minutes old: temp = 10 million degrees, protons/neutrons groups of four to form helium nuclei, thick fog of radiation

one million years old: atoms of hydrogen and helium (previous too hot/to

many collisions for electrons to remain in orbit), fog cleared one billion years old: atoms gravitational attraction, combine, embryonic star

plus 10 million years: attraction great enough, temp = 20 million degrees, nuclear reaction (all elements except hydrogen and helium = "ashes of nuclear reactions in stars" (p.59))

Stars life cycle; old stars=red giants; moderate size stars = white dwarf w/ planetary nebulas; massive stars = supernovas

5. BLACK HOLES AND QUASARS: Oppenheimer's other discovery: collapsing stars . . . astronauts torn apart; X-ray telescopes; giant black holes; quasars are galaxies with giant black hole at the center

PART III: EXPLORING OUR SOLAR SYSTEM

6. THE SUN'S FAMILY: formation of the sun and the large planets (condensation of star-matter); earthlike planets different, balls of iron and rock, solar flares blast away lighter elements (gases) leave iron/rock . . . asteroid belts and pull of Jupiter; threat of collision of earth with a large asteroid, eg., Hermes in 1937 (10 ml. diameter, p. 92) = 40,000 hydrogen bombs; the wobble of Uranus' orbit = discovery of Neptune and Pluto and it's moon Charon and questions of a tenth planet; comets; planets with moons: Jupiter's big as planets; captured asteroids; earth's moon is a mystery . . .

Harold Urey, father of lunar science, studied the problem and gave up, saying, "It is easier to pretend the moon is not in the sky than to explain how it came to be there." (p. 98)

7. MANY EARTH'S CIRCLING MANY STARS: old collision theory of planetary creation = collisions rare, there solar systems = rare and therefore life elsewhere = very rare; modern theory, stars grow with planets naturally, possibility of life elsewhere greatly increased; key: other solar systems, where are they?; need for orbiting telescopes; star's wobble; Vega's heat waves, planets being formed; history of theory of common planets: 1600, Giordano Bruno burned at the stake for it

8. THE SEARCH FOR LIFE: the appearance of life on earth

"What scientific evidence supports this remarkable theory of the origin of life? Ther is very little. Laboratory experiments have given us clues to how it all started; they have created the building blocks of life; but but they have not created life itself. Science has never been able to breathe the magic of life into inanimate matter.

"Nor has science been able to determine the likelihood that all this will happen. How often has naure succeeded in creating life out of nonlife? If nature performs that experiment on a thousand earthlike planets, does it succeed in every case, or once in a while, or hardly ever? Perhaps it

succeeded only once, and we are the result of that rare occurrence."

"Many scientists feel the answer is clear. They see life as a natural outcome of the laws of physics and chemistry." (p. 119)

twice in one solar system = life is not rare. Mercury too hot; Venus, green house effect, no life past/present; Mars, interesting possibilities . . .

Mars: abundance of water in the past, atmosphere too thin for it to liquify.

9. MISSION TO MARS: Viking project, 1976, inconclusive evidence of life, one experiment tested for microbe waste products and found them, another tested for presence of molecular building blocks of life and found none.

Mars' moon Phobos, water on its surface and other missions to Mars; USSR in mid-1990s balloon and rover trips.

10. THE MARTIAN EXPERIENCE: oxygen from crushed lunar rocks, artificial gravitation with two ship tethered end to end, radiation hazards, mission control functions on-board (distances too great to wait for earth based controls), aerobraking, and landing.

PART IV: A JOURNEY INTO THE FUTURE

11. ENCOUNTER WITH A STAR: Universe old by the time the sun appeared; great distances, Alpha Centauri, 25 trillion miles away, four years to reach at light speed (186,000 miles a second), conventional rocket speeds 50,000 years to make the trip.

suspended animation; terminal germination (sperm/ova held until near destination---space babies); nuclear rockets, anti-matter rockets (travelling at light-speeds); collisions of light-speed rockets and atomic particles; ; space arks

12. A MESSAGE: earth's radio/TV transmissions since the '60s, why no response? looking for the perfect star;

13. STARS OF PROMISE: 20 stars within 12 light-years, 3 show promise---possibilities with numbers raised to the 40 billion stars within our own galaxy . . .

"These numbers are staggering. Are all thos epromissing stars actually inhabited? Or only a few? Or none, except the sun and its family?

"Some astronomers argue that science already knows the anser to those questions. They reason that the earth is an ordinary kind of planet, containing ordinary materials found in many solar systems. If life emerged on this garden variety of planet, these astronomers ask, why would it not emerge on similar planets elsewhere? Why would the earth alone, among all these planets of the same kind, be chosen by nature or the Deity as the only planet onl whose soil the seed of life can take root?

"Scientists interested in extraterrestrial life call this reasoning the Principle of Mediocrity. The logic of the Principle of Mediocrity seems impeccable: What better evidence can be found that life and intelligence are common in the Universe than the fact that they have evolved on such a common sort of planet as the earth?" (p. 184)

14. REACHING OUT TO COSMIC LIFE: looking for radio signals from the stars; multi-frequency blanket of the heavens = 3,000 year search; universal frequency 1.4 billion cycles per second, hydrogen atoms transmissions; SETI (search for Extraterrestrial Intelligence); risks of encounter . . .

"In the contact between scientifically advanced civilizations and a primitive society---and such is the description we must apply to humans as they prepare to enter the galactic community---it is the usual lot of the less developed peoples to be destroyed by the encounter. Regardless of the intent of the technically advanced civilization, powerful forces at their command tear apart the fabric of the primitive society. Such was the fate of the American Indian, the Australian aborigines, Tasmanians, and Polynesians.

"These have been the fateful consequences of exposure to a more advanced technology when some thousands of years of cultural evolution separate the two societies. What may be expected from a meeting between civilizations separated by many millions of years of evolution? Can mankind survive the shock of the encounter?

"It is too late for these thoughts. The shell of television broadcasts, moving outward from the earth, has swept past many stars like the sun. They know we are here. There is no turning back." (pp. 195-196).

AFTERWARD

THE EVOLVING PERCEPTION OF THE COSMOS: "The earth seems vast and immobile; throughout two million years in the prehistory of man it provided the stage for all human experience, with the heavens seemingly no more than a backdrop of moving lights. Astronomy and the exploration of space have led us to the contrary realization that the Universe is vast, and the world of men is small." (p. 199)

story of astronomy: some Greeks earth rotates on axis (one added revolves around the sun!); planets (wandering stars) Apollonius/Hiparchus' theory of the wheels; Ptolemy, 2 A.D., 40 wheels; 1500 Copernicus --> planets like the earth, planet and possibility of life elsewhere . . .

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